Measurements of low mass e^+e^- pairs in p+p and Au+Au collisions with the HBD upgrade of the PHENIX detector

Abstract

Dileptons are important probes in the investigation of the hot and dense matter formed in heavy ion collisions. Their importance lays in the fact that they interact only electromagnetically and thus their path from the interaction region to the detectors is almost undisturbed. Dileptons can provide information about the matter properties in the early stages of the collisions where deconfinement and chiral symmetry restoration are expected to take place.

The measurement of dileptons in heavy ion collisions is a challenging task, especially in the low mass region ($m < 1\ GeV/c^2$), due to the overwhelming yield of π^0 Dalitz decays and photon conversions, which produce a large combinatorial background. In order to cope with this situation, the PHENIX spectrometer has been upgraded with a Hadron Blind Detector (HBD). The HBD is a windowless Cherenkov detector, operating with pure CF_4, using triple GEM elements with a CsI photocatode and pad readout. The HBD rejects more than 90% of the combinatorial background by exploiting the small opening angle of the π^0 Dalitz and conversion pairs.

The HBD was successfully operated during Run 9 and Run 10 at RHIC in the measurements of e^+e^- pairs in p+p collisions at $\sqrt{s}$=200 GeV and in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV, 62 GeV and 39 GeV. A detailed account of the detector performance will be given, including position resolution, hadron rejection factor, single electron detection efficiency, number of photoelectrons and the associated figure of merit N_0 and single electron versus double electron hit recognition. The status of the low mass e^+e^- pair analysis, with a significantly improved signal to background ratio, will be presented.